

Partially closed aeolian/alluvial sedimentary systems on Mojave Desert alluvial fans

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The Marine Corps training base at Twenty Nine Palms, CA, situated in the southern Mojave Desert includes a series of high relief, north-west/south-east trending rock ridges and intervening plains and valleys. The rock ridges partially block the prevailing north -west to south-east aeolian sand transport paths such that alluvial fans on west facing slopes are mantled with sand, including transverse and swept dunes. In some places sand climbs sufficiently high to leak through the ridges and to drape east facing slopes and to continue on to the next ridge.

The sand covered fan surfaces are cut by deep, sometimes meandering alluvial drainage channels that incise the mid fan surfaces and terminate lower down on the lower and distal fan as delta-like units or splays. These channels give rise to a system in which water is transported across the upper and mid-fan surfaces in quasi-stable channels that lack the more extensive dispersal characteristics of normal alluvial fan channels. At the upper end of these channels they connect to rock-bounded or coarse debris-bounded chute-like channels of the upper alluvial fan. In other cases alluvial fan channels have coalesced to flow along the boundary at the top of the aeolian mantled surface of the fan (i.e. obliquely across the upper fan) so beheading alluvial drainage across the mid and lower fan. In both cases the flash flood dominated alluvial systems return stored increments of aeolian sediments to the distal fan and beyond where they are subsequently reworked back up the fan surface by the wind. As a result a partially closed loop of sand transport is developed on these fan systems.

Troops training in the area are reasonably familiar with the hazards attached to flash flood events in the highly confined rock channels and canyons of the higher parts of the rock ridges. Unfortunately, the presence of a constantly rejuvenated supply of sand to the surfaces of the extensively used fan systems makes them particularly hazardous to military personnel because they too now exhibit zones of highly confined flow. Further, most of the fixed plant and facilities of the base are situated in a zone of closed sand circulation requiring costly stabilization and removal of sand washed down by flooding events.